

# *ATP Annual Meeting 1999*



3M/BFGoodrich: Project *TOPCAT*

Tailoring Optical Polymers through a Novel CATalysis System

Lightwave Microsystems/BFGoodrich: Project OASIS

Optical Polymers and Manufacturing Processes for  
Low-Cost WDM Devices And SYStems

## *Outline*

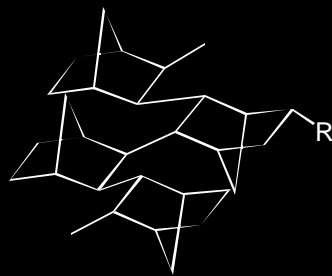


- *Background*
- *Project TOPCAT*
- *Project OASIS*
- *Spin-Offs*
- *Conclusions*

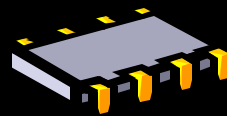
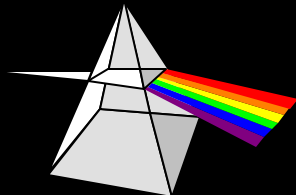
## *Cyclic Olefin Polymers*

- **BFGoodrich**...*A Leader in Cyclic Olefin Chemistry*
  - *Major R&D Focus Area for Over 20 Years*
  - *Encompasses Monomer, Polymer and Catalysis Technology*
  - *Supports Several BFG Businesses*
  - *New Class of High Performance Polymers with Outstanding Optical and Dielectric Performance*

## *Tailoring of Cyclic Olefin Polymers by Judicious Choice of R*



- *Solubility*
- *Toughness*
- *Adhesion*
- *Temperature ( $T_g$ )*
- *Refractive Index*
- *Chemical Reactivity*



## *“Tailored Optical Polymers Through a Novel Catalyst System”*



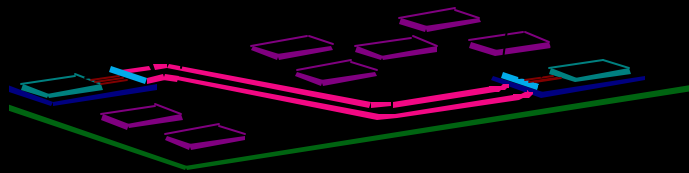
Joint project with 3M

## *3M/BFGoodrich: Project TOPCAT*

### **OBJECTIVES:**

- *Develop Novel Catalysis Systems*
- *Tailor New High Performance Optical Materials*
- *Implement New Designs and Components to Construct High Performance Optical Communication Links*

## *TOPCAT: Develop Polymer-based, Parallel High-Speed Data Links*



**Overall Task: create Chip-to-chip optical data link on board**

## *Material Targets - TOPCAT*

- *< 0.1 dB/cm attenuation at 850 nm*
- *$n$  > 0.02*
- *$n$  constant over temperature range*
- *Solder Reflow Compatible*
- *> 2,000 hours at 125 C in air*

## *TOPCAT: Program Status*

- *Completed 4th Year Review of this 5 Year Program*
- *Demonstrated Bench Scale Working Wave-Guides*
- *Program Meeting Milestones*
- *1 US Patent and 7 Applications*
- *Major Spin-Off Opportunities Defined*

## *Optical Polymers and Manufacturing Processes for Low- Cost WDM Devices and Systems*



**OASIS**

Joint with Lightwave Microsystems

## *Lightwave Microsystems/BFGoodrich: Project OASIS*



### **OBJECTIVES:**

- *Low Optical Loss Polymers at 1300-1550 nm*
- *Add Drop Wave Division Multiplexing Systems*
- *Low-Cost Process for Manufacture*

## *Material Targets - OASIS*



- *$< 0.1$  dB/cm at 1550 nm*
- *$0.006 > \Delta n > 0.017$  (0.4 to 1.2 %)*
- *Core index should match glass*
  - *$n = 1.4450$  @ 1550 nm*
- *Lifetime of 200,000 hours at 150 C (inert atmosphere)*

## *OASIS: Program Status*

- *Program in it's First Quarter Following Repositioning of the Objectives at Kick-Off Meeting*

## *Technology Spin-Offs*

*BFG Core Competency  
Catalysis &  
Cyclic Olefin Technology*



Polymer Resins for  
193 nm Photoresist



Chip Packaging

Low k Dielectrics



Displays

## *Technology Spin-Offs*



### **Polymer Resins for 193 nm Photoresist**

- *Transparency at 193 nm*
- *Robust towards Reactive Ion Etch*
- *Hydrophylic and Hydrophobic Monomer Combinations (Tailoring)*
- *Developmental Sales to Major Suppliers*
  - DUVCOR™ Photoresist Materials

## *Technology Spin-Offs*



### **Chip Packaging**

- *High Temperature*
- *Low Moisture Adsorption*
- *Low Dielectric*
- *Monomer Combinations Selected to fit Balance of Properties Needed (Tailoring)*
- *Products Under Joint Development*
  - AVATREL™ Dielectric Materials



## *Technology Spin-Offs*



### **Low k Dielectrics**

- *Joint Developments with Georgia Institute of Technology (NSF Grant)*
  - *Atrium™ Nano-foam Materials*
  - *Unity™ 400 Air-Gap Materials*

## *Technology Spin-Offs*



### **Displays**

- *US Display Consortium Grant to Produce ITO/Barrier Coated Substrates (\$2.6M)*
  - *Appear™ Optical Polymers*

## *Value of ATP*



- *Disciplined Focus on Definition of Customer's (JV Partner) Need and Business Opportunity*
- *Emphasis on Sound Technology Planning*
- *Fosters Intimate Partner Relationships*
- *Constant Communication: Daily/Weekly/Qtrly*
- *Multiyear Corporate Matching Commitment*
  - *Multiyear Budget*
  - *Corporate Resource Leveraging*
  - *Flexibility of Strategic Shift within Limits*
- *Internal Credibility*